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Installing the Solar-Powered VIA pc-1 Information Community Center

at Ulutogia, Samoa

An Overview of the Solar Technology and Configuration

Bear Systems International Ltd, Samoa

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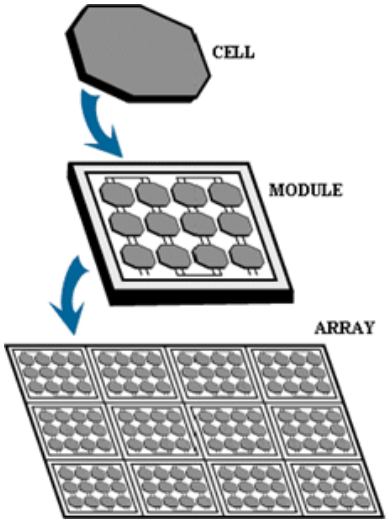
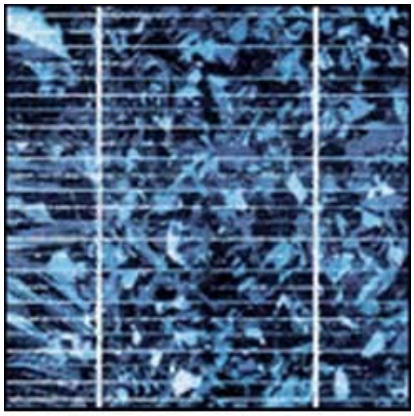
Introduction to Photovoltaic Solar Cells

Photovoltaic (PV) solar cells are solid-state semiconductor devices that convert sunlight into direct current (DC) electricity. These semi-conductors are most commonly made out of silicon. Groups of PV cells are electrically configured and mounted in a support structure or frame called modules or multiple modules, which can be wired together to form an array.




SOLAR CELL CLOSE-UP

Figures 1 & 2: Photovoltaic Solar Cells

In general, the larger the area of a module or array the more electricity it will produce. Regardless of size, a typical silicon PV cell produces about 0.5 to 0.6V DC under open circuit, no-load conditions. The current output of a PV cell depends on its efficiency and size, and is proportional to the intensity of sunlight striking the surface of the cell.

Solar Panel for Samoa

The panel spec at the project site Ulutogia, Samoa is 175W, 4.95A, 35.4V. As can be seen from Figure 1, the setup uses two of the modules wired parallel and connected as an array. The output of the array is 350W, 9.9A, 35.4V.

Figure 3: Motech Solar Panels for Ulutogia

Stand-alone Photovoltaic System @ Ulutogia, Samoa

The highly efficient VIA pc-1 computer systems and Motech photovoltaic power system working at Ulutogia are designed for stand-alone use. This means that the system power source is exclusively PV/Solar power with a large capacity of gel-cell batteries.

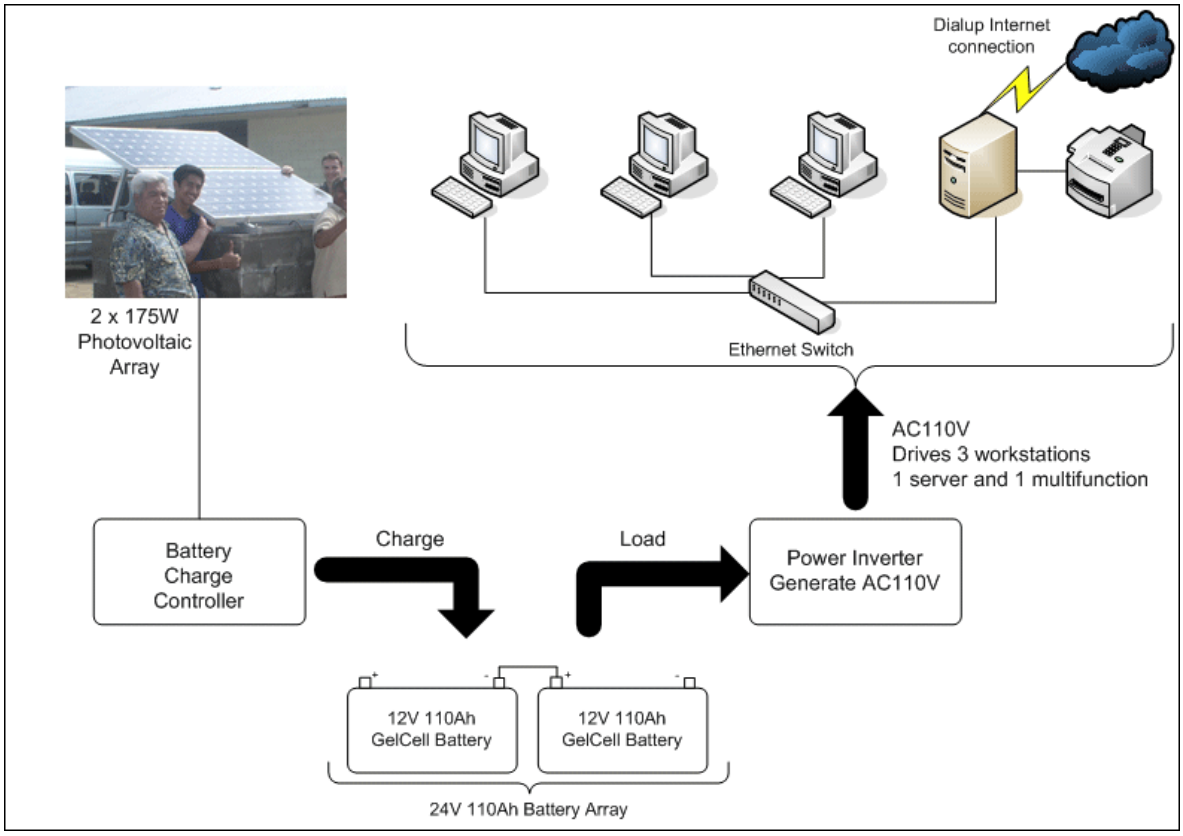


Figure 4: Solar Power Configuration at Ulutogia

The DC power produced by the PV array is regulated by the charge controller then fed to the 24V 110Ah gel-cell battery array. The charge controller also protects these batteries from an over-charge when very strong sunlight strikes the PV array or there is a very low load consumption.

Figure 5: Wall-mounted Configuration Units

While it is possible to operate the computers directly from the batteries, using the power inverter (which converts DC24V to AC110V, or any standard AC voltage depending on the region/country) meant we could plug any computer device to the output of the power inverter without special power configurations on the individual devices. Virtually any kind of electrical devices can be driven by the solar power system, such as TVs, radios, lights, etc, if the PV and batteries are big enough to provide the stored energy.

As shown in Figure 4, right, the VIA pc-1 Information Community Center comprised three VIA pc-1 Power Saving PCs, a VIA pc-1 server and an external fax/scanner/copier/printer, all powered by the dual 175W solar panel units.

Figure 6: Setting Up the Computer Equipment at the Center

Potential Upgrade of the System

Since the power produced from photovoltaic solar cells is dependant on how much sunlight strikes their surface, it is important to position the solar panels for optimal sun exposure, the direction of which changes with the seasons and time of day.

This is especially important in Samoa, which is located about 15 degrees south of the equator, as the sun is located to the north during the dry season and to the south during the wet season.

Since this installation was made during August, we set up the solar panel module facing north on a fixed aluminum frame. This direction can be manually changed to the south during October, than changed back to the north again in April to ensure the maximum amount of sunlight.

Figure 7: Fixed Mounted PV Solar Array on an Aluminum Frame, facing North

This manual operation of physically dismounting the frame and turning it 180 degrees and then mounting it again, is potentially upgradeable to a semi or fully-automatic tracking system. At the same time it would work with east to west tracking to maximize sunlight collection and produce more energy for driving the computers and charging the battery array. In addition, tracking extends the computers operation time during evening use or cloudy days and protects it from accidents that could occur during manual operation. Even though their costs have dropped dramatically over the past 25 years and they are easy to maintain, PV modules are still expensive products and should be looked after.

What We Learned

I would like to share what we learned during the project. The entire system, including the PV solar module, frame, computers and batteries were transported to Samoa by air from the offices of VIA Technologies, Inc. in Taiwan. However, when we unpacked the batteries we encountered a problem, being that there was no voltage from one and very low voltage from the other; terminals that were supposed to be 12V each. It was noted that Samoa's electricity company recently had the same experience with batteries sent by air.

Gel-cell batteries are different from a starter (or car) battery in that no independently liquefied acid is in the battery itself, but rather acid is infiltrated into gelled material. In the case that the gelled material was frozen, the electrical contact would be separated from the material or develop a connection that would damage the battery's functionality. We must assume then that during transportation, the packing was not kept warm enough and the batteries were killed by the long air journey from Taiwan to Samoa.

According to the freight cost and device characteristics (each 110Ah gel-cell battery installed at Ulutogia weighs approx. 40kg), it seems more appropriate to use a surface ship or land transport. Even though well packed and kept warm, batteries need to be protected from low temperatures and any physical damage.

At the time of writing, we had substituted two starter batteries for the damaged gel-cell batteries, but replacement gel-cells were to be shipped shortly.

Figure 8: Damaged Gel-cell Battery Shows Only 5V Output

Connected to the World

The solar powered computer system worked perfectly in the rural village Ulutogia, Samoa as soon as everything was connected up; not only the computers, but the Internet connection and the multifunction printer/scanner/copier and fax in one device, all designed and configured for very low power consumption.

The VIA pc-1 power efficient technology and the tailored Motech solar system are bringing a new lifestyle to people living in rural areas, providing more opportunities to communicate with their families overseas, more chance to get news from around the globe, as well as opportunities to promote their local products to the rest of the world.

Figures 9, 10 & 11: The Excited Ulutogia Community

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